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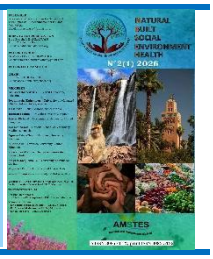


# Water and the Future of the Middle East & North Africa (MENA)

Michael Brett-Crowther *

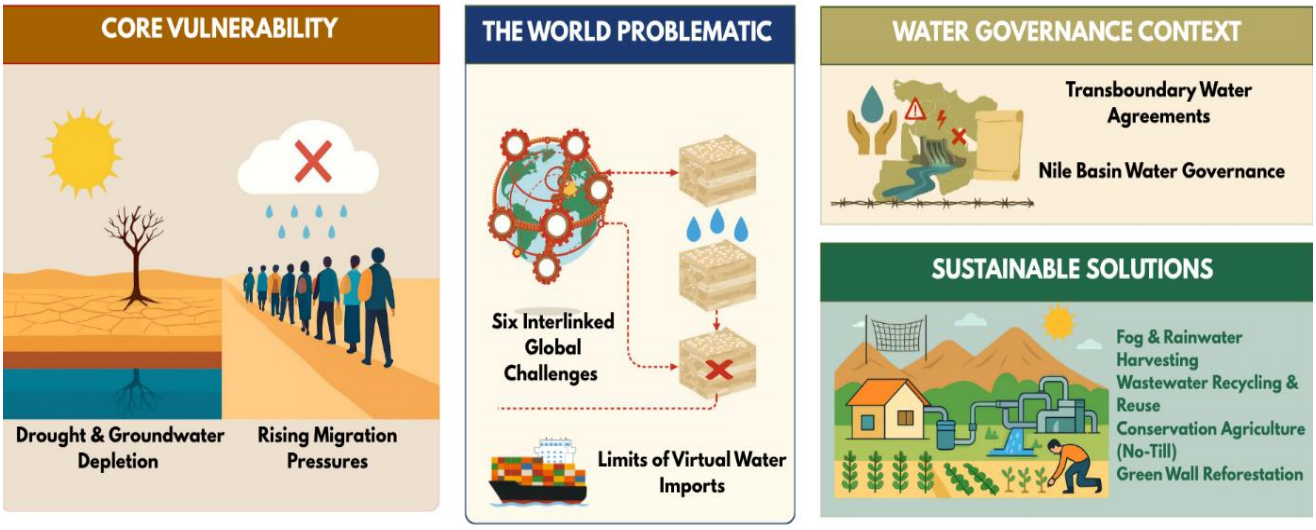
Editor, *Natural Built Social Environment Health*

1 rue des Albizias, Queue d'Ageasse, 79190 Lorigné, Deux-Sèvres, France

***Corresponding author:** drmichaelbrettcrowther@gmail.com

## Graphical Abstract

Water stands at the centre of the "world problematic", where food security, migration, conflict, energy, and ecological decline converge within an increasingly fragile global system. Across the Middle East and North Africa, geopolitical rivalries, demographic pressures, and technocratic ambitions have intensified water scarcity, even where technical solutions already exist. Conservation, recycling, rainwater harvesting, wastewater reuse, and regional cooperation are essential responses.

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**Abstract:** Water is central in the "world problematic", linking food, energy, poverty, migration, conflict, and development within a deeply interconnected ecological system. The water crises affecting the Middle East and North Africa merge with geopolitical tensions, national ambitions, demographic pressures, and the technocratic planning that accompanied dam policies and agricultural expansion. Examples such as the Nile and the Tigris and Euphrates, Morocco, Ukraine, the African Green Wall, and major hydraulic projects in Ghana and Ethiopia show that technical solutions often exist, yet fail because of political inaction, economic interests, and the absence of genuine cooperation. There is a need for new forms of conservation, recycling, and water reuse — including wastewater recovery, ablution water reuse, drip irrigation, fog harvesting, and rainwater collection — in order to adapt societies to water scarcity. If governments continue to ignore the interdependence between environment, justice, and human survival, ecological disasters, mass migration, and conflicts over water may become the normal condition of the future world.

***Keywords:*** *Water scarcity, MENA region, Water governance.*

**Water and the future of the Middle East & North Africa (MENA)**

" 'Ecology', wrote Sir Julian Huxley, 'is the science of interrelations. It studies the balance to be achieved in a system of interacting factors.' It is, in fact, essentially a dynamic subject, and it is ultimately resolvable into the role of the individual organism in these cycles of production and breakdown that characterize the ecosystem - cycles which may be seen to group themselves under three headings - energy, nutrients and water. A dynamic approach to ecology provides a framework on which it is possible to hang the unifying principles which bring together its various branches" [1]. Black also notes: 'Man is, indeed, in the centre of the ecological system, and whatever he does alters the delicate balance of the components and reacts upon himself [1, p. 5]

Every living being needs water. The Holy Quran states that all life began in water (Surah An-Nur - 45) (24:45). Water makes up at least 60 percent of the human body. Water is sometimes defined as being a basic human right. In MENA, water is a vulnerable resource because precipitation is often irregular and unevenly distributed, groundwater reserves are depleted, rivers are not abundant, drought is a common experience, and so living conditions for many are poor. One result is pressure to leave the affected area.

At the sixth special session of the U.N. General Assembly, Plenary Meeting 2207, 9 April 1974, Kurt Waldheim, then Secretary General, U.N., defined six primary problems: food, energy, population, mass poverty, military expenditure, world monetary system [2]. These we regard as constituting the world problematic. A problematic – *problématique* (Fr); *problematik* (Ger) - is a multi-problem; its interactions offer solutions. This idea appears notably in a lecture by Aldous Huxley in 1963 [3] and two books by C.H. Waddington [4,5].

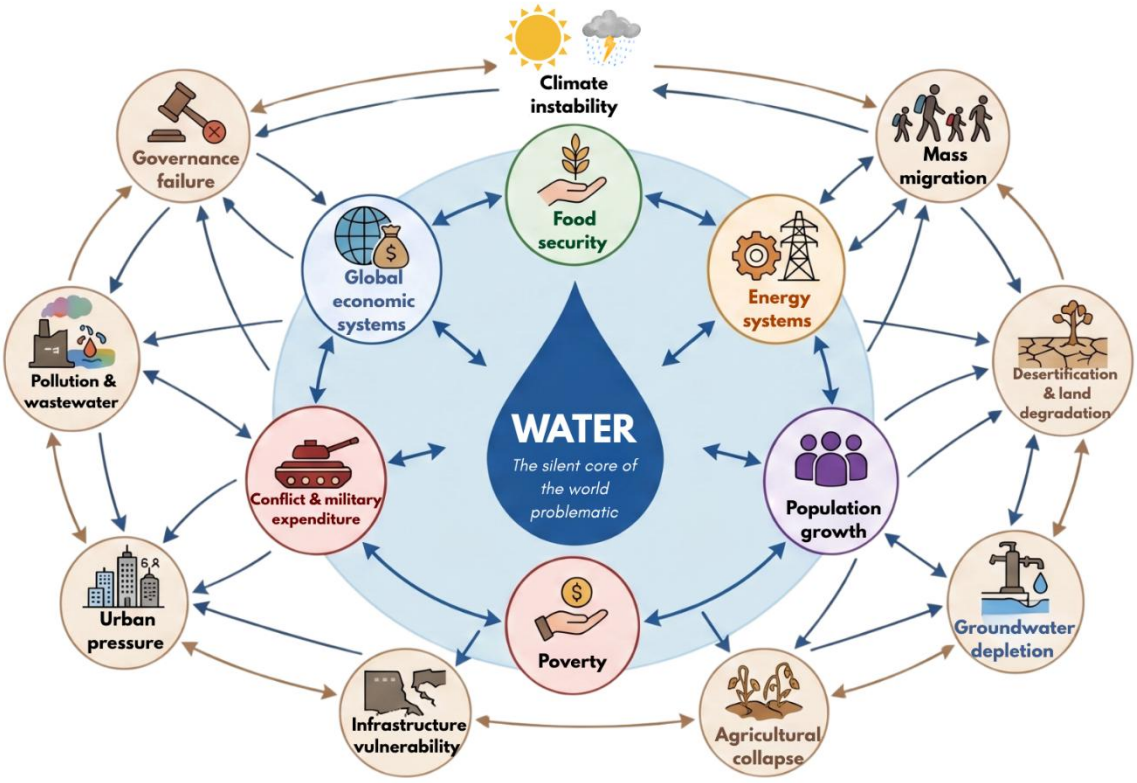


**Figure 1.** Water at the centre of the world problematic

The world problematic, or the world multi-problem, is the six primary problems. These problems all concern water. How can they not? Briefly, the major crops of rice and wheat and herds of livestock depend on water. Energy systems include hydro-electricity and water for coolant in nuclear power plants. Populations need water for hydration, cooking and sanitation. Mass poverty is accompanied by a water shortage or the presence of floodwaters. Military expenditure tends to equal or exceed the costs of development, and development always requires and affects water. The world monetary system since 1945 has been dominated by the US dollar, and through the World Bank and the International Monetary Fund it has been central to water-related development in many countries. The world monetary system is now subject to gigantic forces of speculation, cryptocurrency movement, and the games of billionaires.

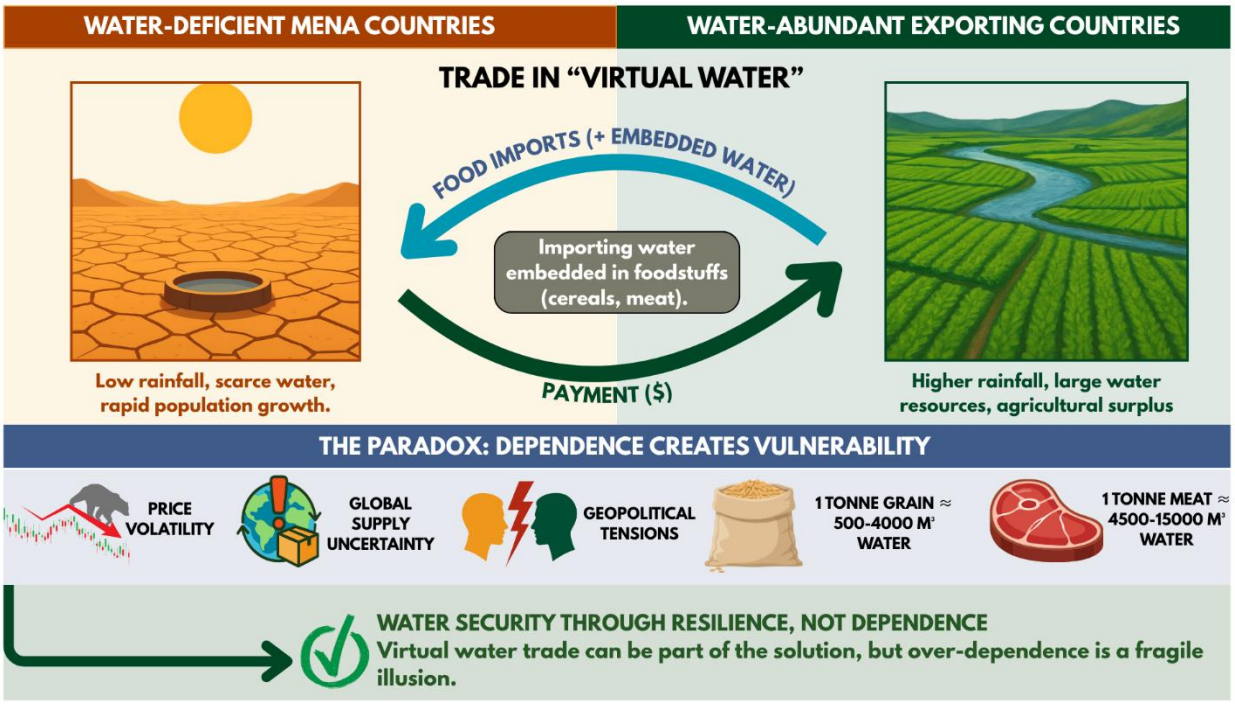
WATER-DEFICIENT MENA COUNTRIES
WATER-ABUNDANT EXPORTING COUNTRIES
TRADE IN "VIRTUAL WATER"
FOOD IMPORTS (+ EMBEDDED WATER)
Importing water embedded in foodstuffs (cereals, meat).
PAYMENT ($)
Low rainfall, scarce water, rapid population growth.
Higher rainfall, large water resources, agricultural surplus
THE PARADOX: DEPENDENCE CREATES VULNERABILITY
PRICE VOLATILITY
GLOBAL SUPPLY UNCERTAINTY
GEOPOLITICAL TENSIONS
1 TONNE GRAIN ≈ 500-4000 M³ WATER
1 TONNE MEAT ≈ 4500-15000 M³ WATER
WATER SECURITY THROUGH RESILIENCE, NOT DEPENDENCE
Virtual water trade can be part of the solution, but over-dependence is a fragile illusion.

**Figure 2.** The paradox of virtual water dependence in MENA

There is another dynamic relation to be considered, proposed by J.A. Allan in 2009 [6], that of virtual or embedded water in regard to these problems This idea of virtual or embedded water means that water-deficient areas overcome their problem by importing water in the form of the foodstuffs which have been grown using water in water-abundant countries. Thus, disputes about water - because disputes arise over transboundary flows or restrictions of flow in regard to rivers - should be unnecessary. The idea concerns most imports of cereals. The difficulty is that the idea of embedded water collides with some hard facts. Foreign exchange may not be adequate in some poor countries. The amounts of water needed to produce goods for trade may be very great; e.g., it takes 500-4000 tonnes of water to grow a tonne of grain, depending on location and the maximum difficulty is in MENA, and 4500 to 15 000 tonnes of water to produce a tonne of meat (personal communication, David Dent, January 3 2026). It is not certain that the producer countries will continue to have abundant water. In addition, MENA has urban centres and well established rural centres. It is culturally normal to have a family farm and to work it in a traditional way. So, there is resistance to depending on outside sources, although many MENA countries do. The problem is like persuading village India to give up cooking with cowpats to depend on paraffin or bottled gas. More alarmingly, if one thinks of emergencies, one thinks of famines in several countries at once and the difficulty of supplying their need with imports of grain from the US, where stockpiles are not certain to be adequate. And the U.S. has its own problem of reduced water availability; e.g., in

California. If Muslim, anti-communist Indonesia had a famine at the same time as capitalist but also communist China, or Muslim Pakistan and Hindu India, who would be given food grains and or feed grains first? The fact of human nature and actual cultural patterns is a harder fact than that of virtual water. Further, US politics do not encourage belief in reliable responses to the world outside the US.

Houari Boumedienne made some telling points in an interview with *The Times* in 1974:

'With Europe we could start to build up a new kind of world society, with more human and spiritual values, in which human beings can find true fulfilment, and where poverty and misery can be eliminated. Together we could seek a new life-style which will make possible the sustenance of the 8,000 million people expected on this planet by the year 2,000. Otherwise, no number of atom bombs will stop the tidal wave of billions of human beings who will one day break out of the poor south of the world into the relatively open spaces of the rich north in search of survival [7].' This prospect of world war was clear to Boumedienne, and today, in 2026, it seems still to be a great danger.

Boumedienne was right. Various problems have been pushing people out of their homes for many decades. There is migration into Europe from South of the Sahel and from MENA. Boumedienne's hope for 'a new kind of world society, with more human and spiritual values' is integral to the European Union. But we must not ignore the opposite effects of world politics and human aggression. A century ago, world politics included 'the scramble for Africa', whereas now after all the changes, China and the United States and Saudi Arabia seem to reverse the trend. Africa is being re-colonized. The toxicity of water in Zambia with depleted fishing stocks appears to be related to Chinese management of copper mines [8]. The luxury of the Gulf States complicates assessment. Their carbon footprint contradicts their innovations in solar energy and desalination (distillation of seawater).

The Global Challenges Foundation has produced a report on Global Catastrophic Risks 2026. This identifies 4 areas: Catastrophic Global Change, Ecological Collapse, Weapons of Mass Destruction, and Near Earth Asteroids [9]. All predictions are meant to provoke action in the immediate situation, because the willingness to prepare for a future event depends on many variables, and options are always being reduced by the passage of time. Talking about a tipping point, or leverage, or governance, or justice does not cause action to follow. These analyses do not appear in the ordinary newspapers, or most radio or television programs. It is also necessary to say that rational thinking is frequently absent. The person who knows that water pollution can be reduced is not the same as the person who may, e.g., control the tanning factory using chemicals

which are discharged to the river; and he may have no interest at all in maintaining any system to reduce those chemicals or to separate them from the receiving water body. If someone refuses to pay for his pollution, the principle that the Polluter Pays must be enforced. How can the law be enforced when the legal system is compromised? Many countries show this problem; including the US.

The great achievement of Boumedienne, the green wall against the desert, remains a resource which can be used and can be replicated. Trees were planted by Boumedienne using armed soldiers to ensure that they were protected as they became established. Enforceable policies for water, conservation, and mitigating the effects of climate change will be necessary if global challenges do not produce global actions. The African Union's attempt to replicate the successful green wall appears to have failed, or at least to be interrupted, delayed, incomplete [10]. This shows us that we must either cooperate or be coerced. If we do not willingly, with real cooperation, attempt to solve the six primary problems - the interlinked problems of the environment - we may have to be coerced by governments or compelled by necessity. That necessary compulsion will probably be an accumulation of catastrophes.

**Figure 3.** The evolution of the Green Wall concept

The current division of Libya into two regimes does not appear to be important to the EU, the AU, the US, the GCC. Divided Libya does not evoke any coercive response or any emphatic call for

cooperation. We may ignore data about environmental problems merely because everything else seems to be tolerable - or unimportant. Yet expansion of deforested areas of the Amazon, mounting evidence of the presence of pollutant plastic in the ocean, even at its deepest point - the Mariana Trench - and the apparent worldwide spread of nanoplastics even in Pakistan's salt should require decisive action; and this has been the apparent object of the COPs. But, everything is somehow managed into serious but ineffective words, time and again.

In Russia's invasion of Ukraine in 2022, the Russians seized control of Zaporizhzhia Nuclear Power Station and in 2023 destroyed the Khakovska dam on the river Dniepro (Dnieper). This has not aroused any condemnation from the US. Similarly, the Americans have ignored the Russians' attack on the Chernobyl (Chornobyl) site, and have not condemned Russia for its dangerous activity. Russia's leaders have always controlled the Russian population by repression, and the Kremlin misrepresents Russia's war against Ukraine. If catastrophes at Zhaporizhzhia occur, will the Americans take any serious action against the Russians? The American inaction reflects the arbitrary and destructive decision-making of the current administration. Those features reject the idea of the world problematic and the Sustainable Development Goals.

Let us, instead, be realistic and consider some facts. Morocco's food supplies increased because of population growth from 3.5 to 9.5 million, from 1921 to 1954. Rain-fed agriculture was unreliable. The Kasba Tadla scheme in the Umm er Rabia basin was inaugurated in 1935 and by 1945, the reclaimed areas were a complete success. A tributary of the Um er Rabia was then harnessed, the Ouad el Abid. The gorge for this ran at a higher level and could be more easily dammed. When this was finished in 1952, the height - about 222 metres / 400 feet - was the highest in North Africa, and it held 1.5 milliards of water - a greater volume than was held by the Assuan reservoir across the Nile.

Water released from the Ben el Ouidane dam went first to hydro-electricity stations then was diverted north in a tunnel through the dividing ridge between the two rivers; then into the Umm er Rabia valley. From here the water went to the Beni Moussa plain to irrigate excellent land [11].

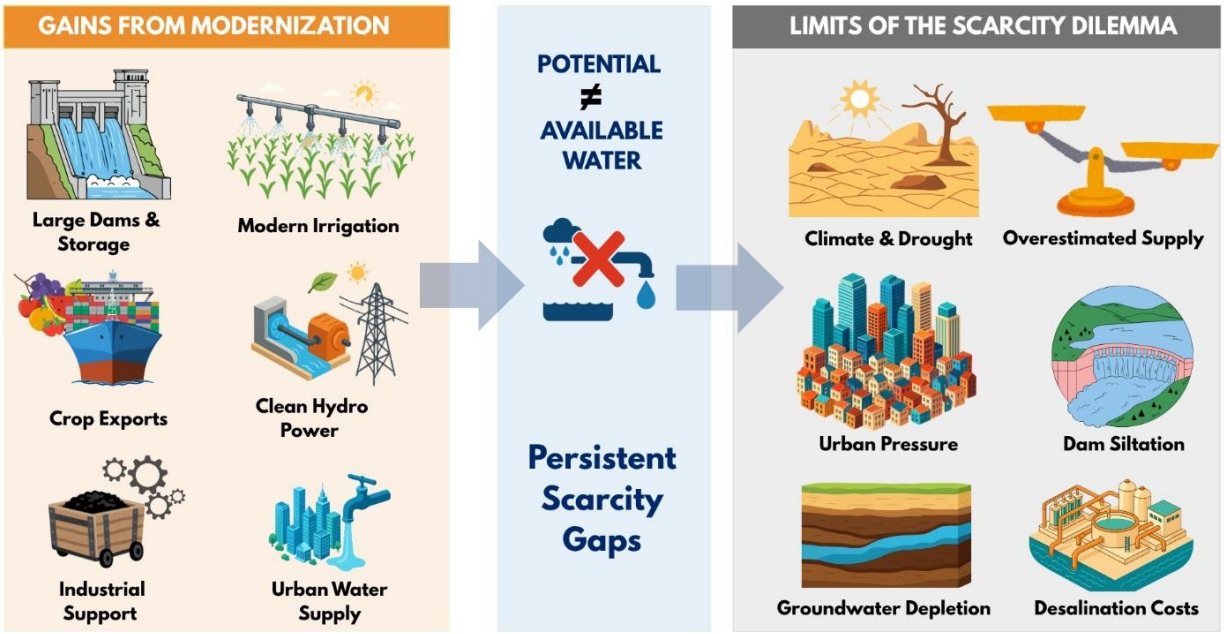


**Figure 4.** Morocco's hydraulic modernization and the scarcity dilemma

In 1977, it was believed that probably 155,000 hectares were under irrigation in Morocco, and that a further 930,000 hectares could become cultivable if they were irrigated. It was also clear in 1977 that dry-land areas could produce cereals with high-yielding varieties and chemical fertilizers [12]. There has been research in Morocco into the agri-food system, and an excellent monograph edited by Nadia Boutaleb brings many of these matters up to date [13]. Morocco is now a successful exporter of food to the European Union. Her economic development through phosphate exploitation and the development of tourism is impressive.

But Morocco has a water problem, and a population of 38.8 million (2026). For many years, the idea of 'renewable' water or 'exploitable water' and 'hydraulic potential' has been current in regard to Morocco's development. This idea is related to quantification of water in regard to agricultural expansion [14]. The 'dam policy' inaugurated in 1967 aimed to irrigate 1 million ha by the year 2000. One result appears to have been to confuse 'potential' with actual limits, and perhaps also 'potential' has been exaggerated by 50 percent [15, 16]. The water storage capacity increased from 1.5 $Bm^3$ in 1956 to 16 $Bm^3$ in 2000. It is probable that inaccurate figures have crept into the policy making, so that instead of 20–22 $Bm^3$ of available water, there may be in fact only half that volume [16].

The discrepancies among figures and definitions of water (renewable, exploitable, unconventional) mean that the anticipated need for water in Morocco cannot be met from the existing resource base. If desalination (distillation) is chosen, both capital costs and operating cost may be very high. If reuse and recycling of wastewater is applied more widely, this, like distillation, has considerable

costs and requires changes in infrastructure. But there are also benefits. Retrofitting rainwater collecting systems to houses is advisable, which means also attempting small-scale purification of the harvested rainwater (e.g., from apartment blocks). The removal of sediment from dams and its application to fields as a form of soil amendment is also advisable. Collecting fog water is another option in certain areas [17]. Reuse and recycling includes ablution water from mosques in some countries [18]. It is not known whether this has been considered by the authorities in Morocco. There appears to be a debate within Islam on the reuse of water for ablution water [19]. There is certainly a view that *water used for ablution can be reused after ablution has taken place* [18]. This is authorized by *fatwa* in Yemen and in Oman, in Indonesia and Malaysia. A study of the potential for the reuse of ablution water in Morocco may disclose a potential well beyond expectations. The general idea of abundant water may be perhaps set aside for an idea of expanded uses of wastewater. These uses may include sites where circumstances permit the introduction of constructed wetlands [20].

But local development is often questionable. The Volta River Project was established to develop the bauxite resources of Ghana. It began with the damming of a huge area, making the Akosombo Dam the largest by area in the world. No environmental impact assessment was undertaken. After the dam was built, British scientists William Kershaw and Michael Pugh Thomas were brought in to survey the project and assess it (personal communication, 1973). Pugh Thomas was a freshwater biologist, Kershaw a tropical medicine specialist, in trypanosomiasis. These researchers realized that no-one had considered the effects of the scheme beforehand. In the late 1950s, there was no environmental impact assessment.

The American investment in the dam gave the majority benefit to the aluminium producers. The dam produced some electricity for Ghana and neighbouring countries. But the dam buried the best soils under its extensive waters. Fertilizers had to be applied to the remaining available farmland, and eutrophication of the waters in the dam followed.

These matters do not appear in the Central Intelligence Agency's analysis of the Volta River Project, available in a sanitized version on the Internet [21]. Instead, it is clear that Kwame Nkrumah was over-ambitious, was out-manoeuvred by the two American companies who were negotiating for the bauxite, and control of the project, and who produced a low price for the electricity, but did not increase productivity or employment or make the project profitable, for Ghana. The United States gained influence in Africa. Ghana’s debt was used to strengthen that influence. China has done the same with its international loans, in the Belt and Road system of expanding world influence.

Similar stories can be found for many big dam projects elsewhere in Africa. At present, there are still echoes coming from the decision by Ethiopia to build the Grand Ethiopian Renaissance Dam (GERD) on the Blue Nile. This will reduce the available water for Egypt and Sudan as a result. GERD may be justified as a producer of electricity, but it is not so obvious that Ethiopia has the capacity to use electricity or the pipework or tanker system to supply mountain settlements. Ethiopia's population is, however, very great (pop 138, 575, 630) and there is a lack of family planning. Nevertheless, these are not reasons for allowing Egypt (pop 120, 012, 870) and Sudan (pop 52, 763, 790) to have the majority of the Nile's water [22, 23].

In a customary phrase, Egypt is the gift of the Nile. In Pharaonic times, huge structures - the Pyramids, various temples, major cities - were constructed from stone moved by vessels along the river and then moved into place. Necessary crops depended on the river - as they still do and its waters were a means of transport for all commodities and resources. In 1929, Great Britain produced a diplomatic Note which stated that the greatest allocation of the Nile's water was for Egypt. Every other country in the river basin 'shared' to a much lesser extent the waters on which they relied. In 1959, Egypt and Sudan made a treaty confirming their shares of the Nile and *showing no concern for any other country*. Yet there are eleven countries within the Nile river basin: Burundi, the Democratic Republic of the Congo, Egypt, Ethiopia, Eritrea, Kenya, Rwanda, Sudan, South Sudan, Tanzania, and Uganda.

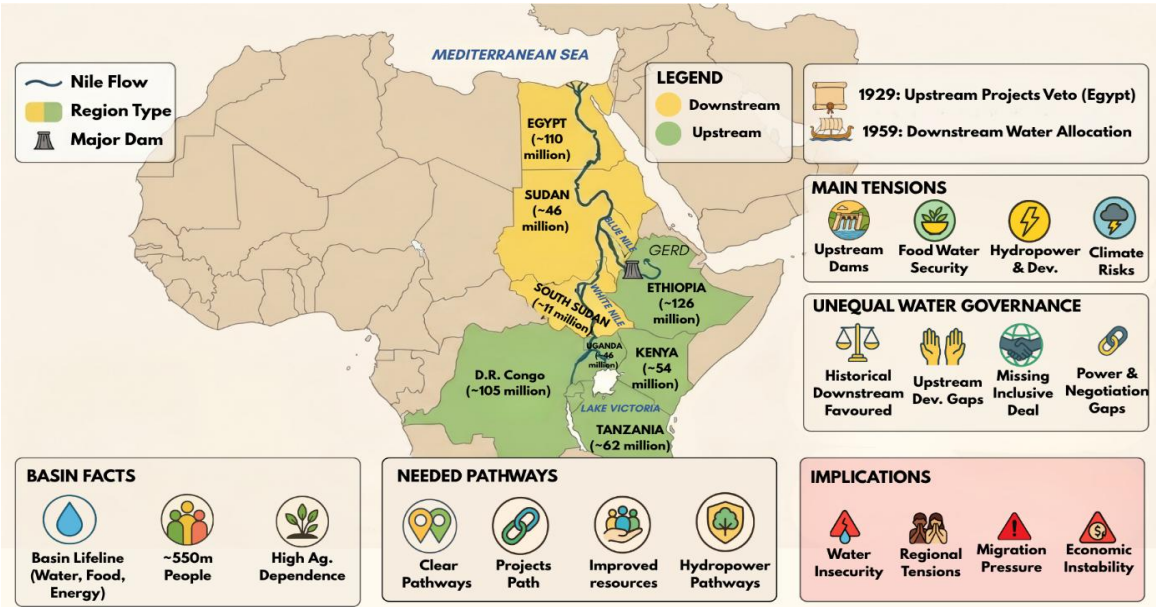


**Figure 5.** Nile Basin tensions and unequal water governance

Egypt has indicated that if the GERD reduces the water available for Egypt, that will be treated as a *casus belli*. This is a dangerous idea. It is not related by Egypt to any idea of reuse and recycling

of water, of the need for a small population, of the need to conserve water, of the injustice of the 1929 Note and the 1959 Treaty. Nor is there any idea of controlling population numbers or of conservation of water in Sudan. Equally disturbing is the fact that all these riparian countries are unstable, more or less, engaged in warfare to some extent (including combating anti-government forces), and not developing adequately. Libya is controlled by two rival governments and is a centre for migration to the rich north. Sudan is split between two military forces. South Sudan is in almost the same situation.

The enormous size of Egypt's population related to its resource base, including income from tourism, cannot be ignored. There is extensive poverty in Cairo, in Alexandria and elsewhere. Virtual or actual poverty is present also in Sudan and South Sudan. *Poverty is a harder fact than virtual water*. The injustice of relying in 2026 on the 1929 Note and the 1959 treaty is that in 1929, industrial needs and population growth were relatively insignificant in Egypt and Sudan then; and slight or non-existent in the other countries. For Egypt and Sudan to hold a majority allocation of water in 2026 is asking for trouble. Every human being has a right to justice.

Egypt and Sudan and South Sudan should all focus on water conservation and reducing their populations by family planning programs, with additional programs for development in line with the Sustainable Development Goals. This can also be said about all the other riparian states whose use of the Nile is crucial to their lives [22-24].

And can it not be said also to Turkey, which controls by many dams the waters flowing to the Tigris and Euphrates which are the source of life for Iraq? And to Iran which controls rivers flowing into Iraq? And what of Iran's current predicament in regard to the water supply of Tehran, from which its government has said the population - a mere ten million human beings - should be evacuated, because the water is running out? And what of Iran's actual status as a country 5 times larger than France, with 85% of its territory desert, a perpetual problem of sandstorms, and the almost entire loss of Lake Urmia [25]?

The most extreme form of these contrasting issues may be that of Palestine and Israel. Israel effectively controls all the water of Palestine. This cannot be justified. As for Israel, for several decades. Israel promoted economic use of water and sustainable agriculture by offering learning visits to appropriate researchers and practitioners in developing countries. Israel has not, however, used these measures by active diplomacy towards its regional neighbours. MENA includes Israel. Israel has done little to ingratiate itself with its Arab neighbours. Yet promoting effective use of limited water by visits from or demonstrations in MENA could promote acceptance of Israel. Although Israel has developed economic forms of irrigation, these have not been used to bring

peace to the region. Palestinians see their need to use their water *as being also their right to that water.*

Perhaps matters can be improved on the simple basis that the existing solutions can be applied, whatever their source, because the information is more or less in the public domain. Within Morocco, the company Agromillora, at Benslimane, produces many sapling trees each year by advanced propagation techniques. These can be replicated in other parts of MENA, with the same good effect. Covered areas of lightly watered plants in a controlled environment can produce food crops and plants for producing ground cover and re-establishing forest, where intercropping can be practised.

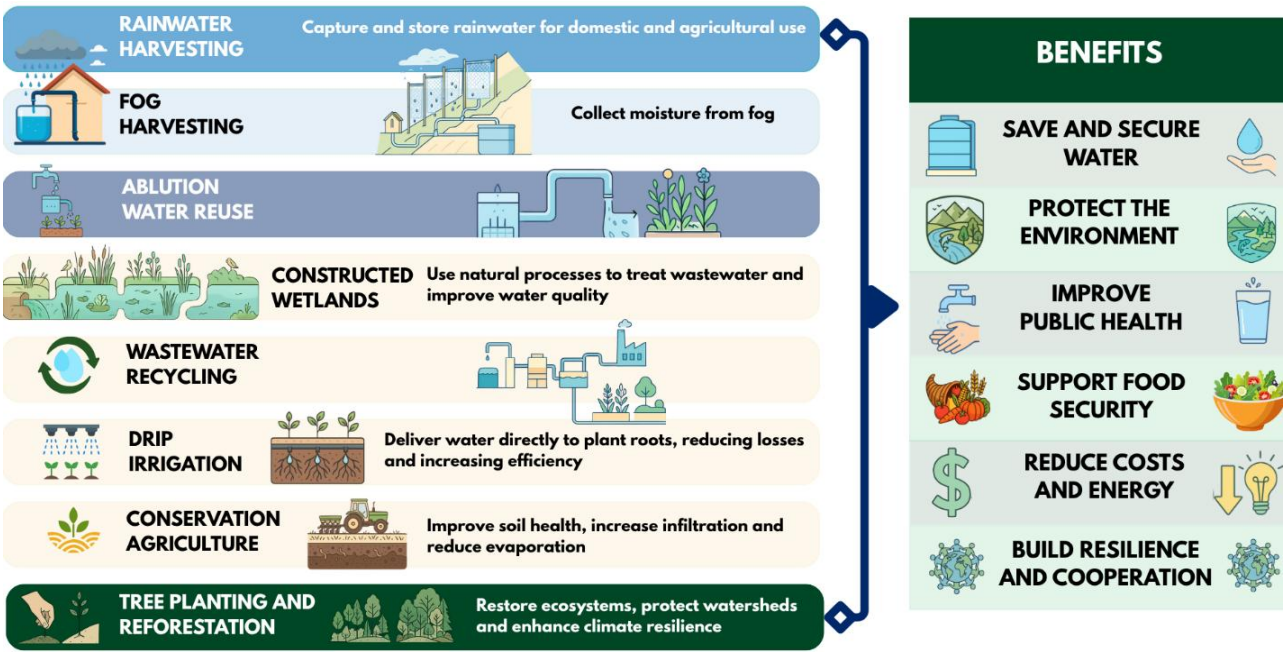
RAINWATER HARVESTING
Capture and store rainwater for domestic and agricultural use
FOG HARVESTING
Collect moisture from fog
ABLUTION WATER REUSE
CONSTRUCTED WETLANDS
Use natural processes to treat wastewater and improve water quality
WASTEWATER RECYCLING
DRIP IRRIGATION
Deliver water directly to plant roots, reducing losses and increasing efficiency
CONSERVATION AGRICULTURE
Improve soil health, increase infiltration and reduce evaporation
TREE PLANTING AND REFORESTATION
Restore ecosystems, protect watersheds and enhance climate resilience
BENEFITS
SAVE AND SECURE WATER
PROTECT THE ENVIRONMENT
IMPROVE PUBLIC HEALTH
SUPPORT FOOD SECURITY
REDUCE COSTS AND ENERGY
BUILD RESILIENCE AND COOPERATION

**Figure 6.** Adaptive water solutions for MENA

Drip or trickle irrigation instead of sprinkler irrigation can conserve water and produce adequate quality.

Discarding tillage and applying Conservation Agriculture avoids losing topsoil, which is a major problem, as it seems to justify amounts of chemical pesticides and chemical fertilizers that cause financial burdens and affect human health. Using compost and encouraging its production for export to other countries is desirable. Morocco has impressive fishing and poultry industries. The debris generated can be used as components of compost for sale throughout MENA [26].

Another question about water is its contamination. Britain has had numerous problems of discharge of raw sewage to its rivers and into the sea, after the businesses which were responsible for water supply failed to maintain the systems but paid profitable dividends to their shareholders. Consumerism is never a good idea. Margaret Thatcher's idea of selling off British water resources to private companies was self-destructive. The pollution of drinking water on land is accompanied by pollution of the world's ocean - in every country.

For all the years since the Stockholm Conference on the Environment, in 1972, mankind has pretended that 'the environment' is some kind of problem which can be managed and which does not require any serious change of direction in human affairs. All the evidence is against this idea [27]. The data may be denied, but they cannot be obliterated. The political system everywhere is ill adapted to these facts and in some cases, notably the United States, it actively pretends that the facts are 'a hoax'.

Just as risks which were once calculated according to probability have become more difficult to calculate, because the least probable has become more normal than abnormal, so we may now have to consider remedies to problems by innovatively using existing devices but for extraordinary purposes in a world where they have become more normal than extraordinary. For example, desalination is extensively used by Kuwait. Perhaps oil tankers should be repurposed to transport freshwater from countries with a surplus (e.g., Ireland, France) to countries with a deficit (e.g., MENA). Further, stormwater including monsoon floodwaters, could be salvaged and transported from the Indian subcontinent to MENA. Harvesting rainwater is normal in India and Australia. Why should not stormwater be harvested? Why should not fog water be harvested [28]?

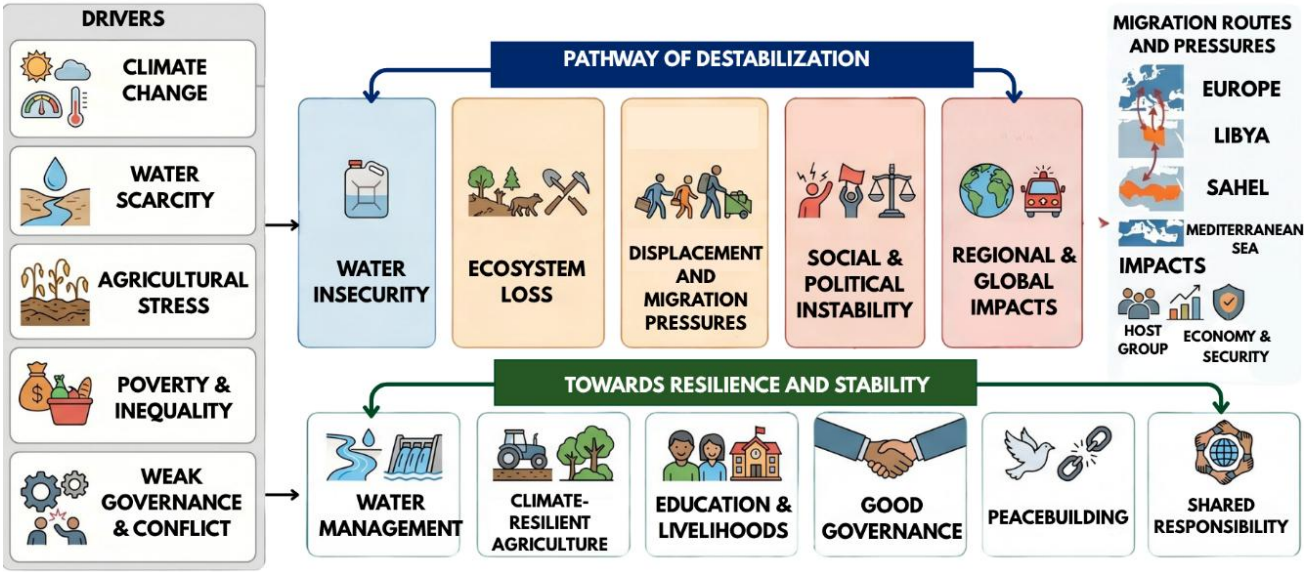

**Figure 7.** Water insecurity, migration, and ecological destabilization

At the end of 2025, Greece faced a fivefold increase in migrant arrivals via the Libya route [29]. From January to late December, 19,948 reached Greece from Libya. In all 2024, there were only 4,935. This increase *of more than 400 percent* does not include the many who must be presumed to have drowned in the frequent failures of vessels carrying people to Greece from Libya. On December 27th 2025, a commercial ship picked up 109 migrants south of Gavdos (an islet to the south of Crete) and brought them to Paleochora (on Crete itself). Of these 49 were Egyptian nationals; 40 were Bangladeshis; 20 were from Sudan. In a major rescue in early December, most of the 540 people on board a fishing vessel south of Gavdos were Bangladeshi. This is a devastating burden on resources. Misery is being encouraged by false hope for a better life. Yet the migrants who continue to make these terrifying journeys could stay at home and prosper with different national policies in their countries. World politics must confront the world problematic. National politics must confront the world problematic. Boumedienne was right, but the north and the south must remain in the same world, changed by better policies. Remember one thing. The environment does not need us. We need the environment [30-32].

## References

[1] Black, J. N., 1964. Prolegomenon to the study of natural resources. *Sylva* **45**, 5-9

[2] United Nations (1974, September 17). *2233rd plenary meeting of General Assembly: 29th session* [Video]. UN Audiovisual Library. https://media.un.org/avlibrary/en/asset/d886/d886859

[3] Huxley, A., 1963, *The Politics of Ecology: The Question of Survival* (Santa Barbara: Center for the Study of Democratic Institutions). https://microdutch.org/guru/Huxley-Online/politics_of_ecology.html

[4] Waddington, C. H., 1977. *Tools for thought: How to understand and apply the latest scientific techniques of problem solving*. (New York, NY: Basic Books). https://archive.org/details/toolsforthoughth0000wadd

[5] Waddington, C. H., 1978, T*he Man-Made Future*, (London: Croom Helm).

[6] Allan, J.A., 2000. *The Middle East Water Question:* Hydropolitics and the Global Economy. (London: I.B. Tauris).

[7] *The Times*, April 9, 1974: interview with Vanya Walker-Leigh.

[8] Bhobo, T., 2025, Toxic wastewater from Chinese-owned copper mine threatens Zambian communities and environment. *Chemistry World*. (2025, September 10). https://www.chemistryworld.com/news/toxic-wastewater-from-chinese-owned-copper-mine-threatens-zambian-communities-and-environment

[9] Global Challenges Foundation, 2026, *Global catastrophic risks 2026*. https://globalchallenges.org/gcr-2026/#download

[10] United Nations Convention to Combat Desertification (UNCCD). *Great Green Wall Initiative*. https://www.unccd.int/our-work/ggwi

[11] Herbert, A., 1955, *Land, water and food: A topical commentary on the past, present and future of irrigation, land reclamation and the food supplies they yield*. (London: Chapman & Hall). https://cir.nii.ac.jp/crid/1970867909799034374

[12] Ḥātim, M. ʻA. al-Q., 1977, *Land of the Arabs*. (London: Longman).

[13] Boutaleb, N. (ed.), 2025, Innovating for tomorrow: health, ecology, and sustainability in Morocco. *International Journal of Environmental Studies* **82**(1), 1–2. https://doi.org/10.1080/00207233.2025.2464464

[14] Mayaux, P. -L., & Fernandez, S., 2024, Blinded like a state: Water scarcity and the quantification dilemma in Morocco. *Geoforum*, **155**, 104093. https://doi.org/10.1016/j.geoforum.2024.104093

[15] Swearingen, W. D., 2014, *Moroccan mirages: Agrarian dreams and deceptions, 1912–1986*. Princeton Legacy Library. (Princeton, NJ: Princeton University Press). https://books.google.co.ma/books?id=qPv_AwAAQBAJ

[16] Groupe Eau Lauréats IAV Hassan II., 2022. *Livre blanc sur les ressources en eau au Maroc : Pour une gestion durable assurant la sécurité hydrique du pays*. (October 2022) (Rabat: Groupe Eau Lauréats IAV Hassan II). http://www.abhatoo.net.ma/content/download/90726/2049384/version/1/file/Livre+blanc+sur+les+ressources+en+eau+au+Maroc.pdf

[17] Amiri, A., 2026, *While villages run dry and the desert advances, women in Morocco climb the mountains to catch fog and turn it into drinking water*. *Daily Galaxy*. (May). https://dailygalaxy.com/2026/05/fog-harvesting-morocco-drinking-water/

[18] Mamun, A. A., Muyibi, S. A., & Abdul Razak, N. A. B., 2014, Treatment of used ablution water from IIUM masjid for reuse. *Advances in Environmental Biology* **8**(3), 558–564. https://www.researchgate.net/profile/Mamun-Aa/publication/286129916_Treatment_of_used_ablution_water_from_IIUM_Masjid_for_reuse/links/5ad7096c0f7e9b28593967e1/Treatment-of-used-ablution-water-from-IIUM-Masjid-for-reuse.pdf?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19

[19] Fauzia, A., Maruf, F. E., Fitriyani, F., & Mani, S., 2025, Bridging perceptions: Green Islam and water recycling challenges in Indonesian mosque. In M. D. Rahim (Ed.), *Towards resilient societies: The synergy of religion, education, health, science, and technology* (Vol. 2, 1st ed.). (Boca Raton, FL: CRC Press). https://doi.org/10.1201/9781003654940-39

[20] Scholz, M., & Lee, B., 2005, Constructed wetlands: a review. *International Journal of Environmental Studies* **62**(4), 421–447. https://doi.org/10.1080/00207230500119783

[21] Central Intelligence Agency, 1971, *Ghana's Volta River Project: A limited success* (Intelligence Memorandum No. ER IM 71-52). (Washington, DC: Directorate of Intelligence). https://www.cia.gov/readingroom/docs/CIA-RDP85T00875R001700010003-6.pdf

[22] Abdulrahman, S. A., (2018, November 4). Agreements that favour Egypt's rights to Nile waters are an anachronism. *The Conversation*. https://doi.org/10.64628/AAJ.xuafuayxa

[23] Abdulrahman, S. A., 2019, The River Nile and Ethiopia's Grand Renaissance Dam: challenges to Egypt's security approach. *International Journal of Environmental Studies* **76**(1), 136–149. https://doi.org/10.1080/00207233.2018.1509564

[24] Abdulrahman, S. A., 2020, Water shortage in Iraq's Kurdistan Region: Problems with Iran and possible solutions. *Middle East Journal* **74**(3), 451–460. https://doi.org/10.3751/74.3.21

[25] Abdulrahman, S. A., 2018, The drying up of the Lower Zab River and future water disputes between Iran, Kurdistan Region and Iraq. *International Journal of Environmental Studies* **75**(1), 29–44. https://doi.org/10.1080/00207233.2017.1406725

[26] Foughal, T., 2026, Multilevel optimization of organic waste biotransformation: Effects of substrate composition and operational parameters on biofertilizer quality and biogas production (PhD thesis, Biotechnology, Biochemistry, and Environment). Hassan II University of Casablanca.

[27] Sandeman, J., 2008, The water crisis facing Australia. *International Journal of Environmental Studies* **65**(6), 721–729. https://doi.org/10.1080/00207230802608319

[28] Abdul-Wahab, S. A., & Lea, V., 2008, Reviewing fog water collection worldwide and in Oman. *International Journal of Environmental Studies* **65**(3), 487–500. https://doi.org/10.1080/00207230802149983

[29] Koutroumpis, J., 2025, *Greece faces fivefold surge in migrant arrivals via Libya route*. *Greek Reporter* (December 30). https://www.greekreporter.com/2025/12/30/greece-faces-fivefold-surge-migrant-arrivals-libya-route/

[30] Brett-Crowther, M. R., 2008, Water, society and the future. *International Journal of Environmental Studies* **65**(3), 467–475. https://doi.org/10.1080/00207230802138200

[31] Brett-Crowther, M. R., 2008, Energy, society and the future, *International Journal of Environmental Studies* **65**(3), 477–486. https://doi.org/10.1080/00207230802144356

[32] Lazard, O., & Bin Shahid, A., 2026, *Ecological statecraft in the midst of war: Water, regeneration, and the future of Gulf security*. (Washington, DC: Carnegie Endowment for International Peace). https://assets.carnegieendowment.org/files/Lazard%20Shahid_Complex%20Regeneration%20in%20the%20Gulf.pdf